Price quotes for material were received from several sources. Results were as follows:

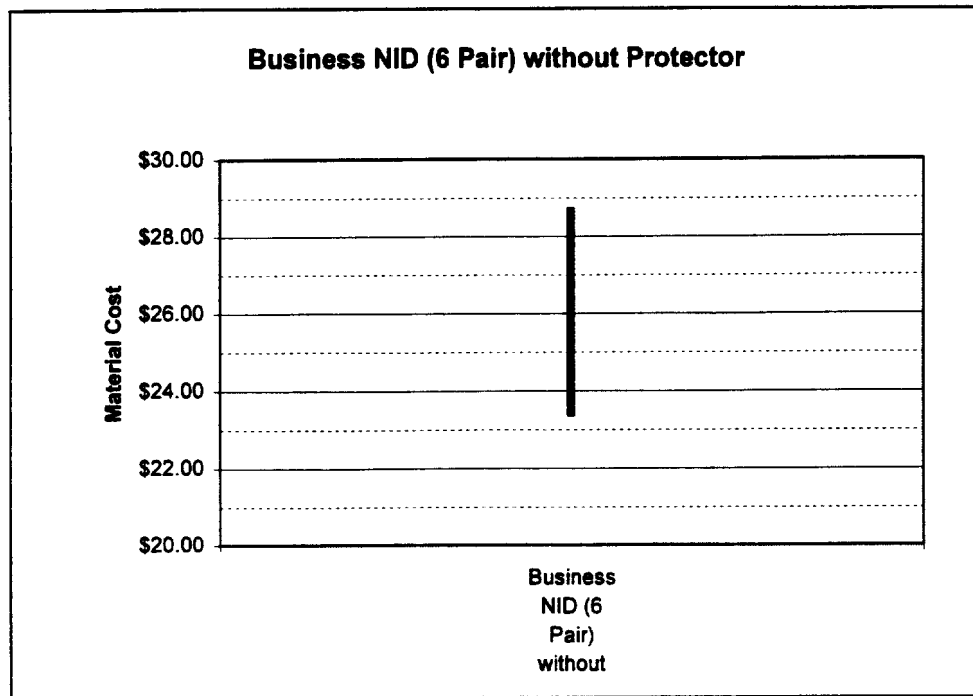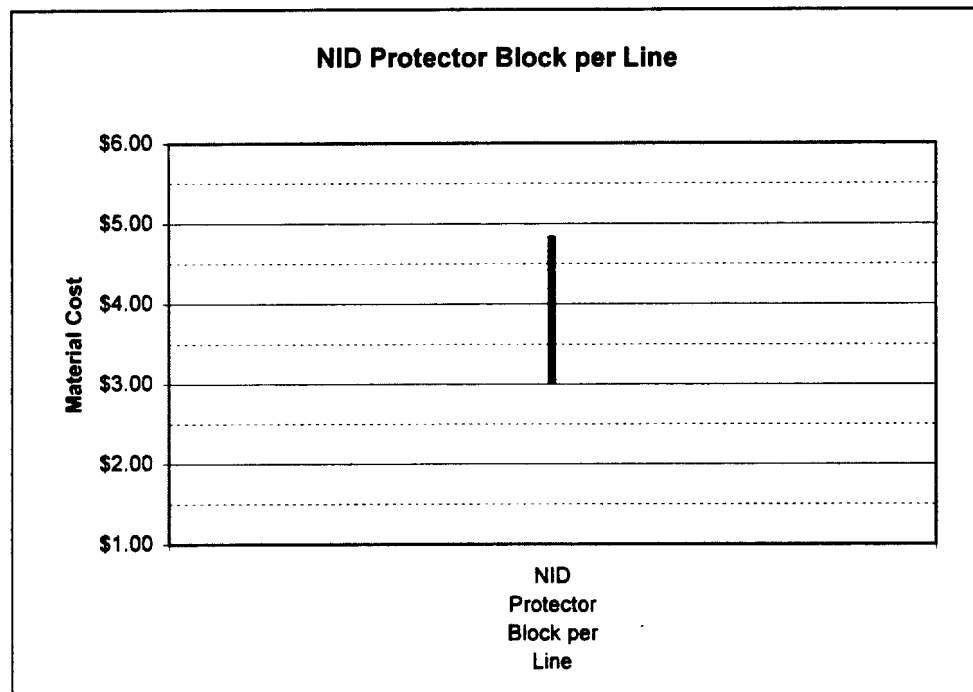**Business NID (6 Pair) without Protector**

d) NID Protection Block per Line

Price quotes for material were received from several sources. Results were as follows:

NID Protector Block per Line

e) Indoor NID Case

Used for subscribers located in high-rise buildings. This is the investment in the NID that serves as the demarcation between subscriber wiring and network facilities. The indoor NID does not contain overvoltage protection devices; investment for these is included in the indoor SAI investment.

2.2. DROP

2.2.1. Drop Distance

Definition: A copper drop wire extends from the NID at the customer's premises to the block terminal at the distribution cable that runs along the street or the lot line. This parameter represents the average length of a drop wire in each of nine density zones.

Default Values:

Drop Distance by Density	
Density Zone	Drop Distance, feet
0-5	150
5-100	150
100-200	100
200-650	100
650-850	50
850-2,550	50
2,550-5,000	50
5,000-10,000	50
10,000+	50

Support: The Hatfield Model (HM) 5.0 assumes that drops are run from the front of the property line. House and building set-backs therefore determine drop length. Set-backs range from as low as 20 ft., in certain urban cases, to longer distances in more rural settings. While HM 5.0 assumes that lot sizes are twice as deep as they are wide, it is assumed that houses and buildings are normally placed towards the front of lots. Reasons for this include the cost of asphalt or cement driveways, unwillingness to remove snow from extremely long driveways in non-sunbelt areas, and the fact that private areas and gardens are usually situated in the backyard of a lot.

It should be noted that although exceptions to drop lengths may be observed, the model operates on average costs within density zones. The last nationwide study of actual loops produced results indicating that the average drop length is 73 feet.[2]

2.2.2. Drop Placement, Aerial and Buried

Definition: The total placement cost by density zone of an aerial drop wire, and the cost per foot for buried drop cable placement, respectively.

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[2] Bellcore, *BOC Notes on the LEC Networks - 1994*, p. 12-9.

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Default Values:

Drop Placement, Aerial & Buried		
Density Zone	Aerial, total	Buried, per foot
0-5	$23.33	$0.60
5-100	$23.33	$0.60
100-200	$17.50	$0.60
200-650	$17.50	$0.60
650-850	$11.67	$0.60
850-2,550	$11.67	$0.60
2,550-5,000	$11.67	$0.75
5,000-10,000	$11.67	$1.50
10,000+	$11.67	$5.00

Support:

Aerial Drop Placement:

The opinions of expert outside plant engineers and estimators were used to project the amount of time necessary to attach a drop wire clamp at a utility pole, string the drop, and attach a drop wire clamp at the house or building. Labor to terminate the drop at the NID and the Block Terminal is included in the NID and Block Terminal investments respectively.

The labor estimate assumes a crew installing aerial drop wires throughout a neighborhood or CBG (in coordination with the installation of NIDs, terminals, and distribution cables), and consists of 10 minutes per drop plus 10 minutes for each 50 ft. of drop strung. The loaded labor rate excludes exempt material loadings which normally include the material cost of the Aerial Drop Wire.

Aerial Drop Placement				
Density Zone	Aerial Drop Length (ft.)	Installation Time (min.)	Direct Loaded Labor Rate $/hr.	Aerial Total
0-5	150	40	$35	$23.33
5-100	150	40	$35	$23.33
100-200	100	30	$35	$17.50
200-650	100	30	$35	$17.50
650-850	50	20	$35	$11.67
850-2,550	50	20	$35	$11.67
2,550-5,000	50	20	$35	$11.67
5,000-10,000	50	20	$35	$11.67
10,000+	50	20	$35	$11.67

Buried Drop Placement

The labor estimate is based on a crew installing buried drop wires throughout a neighborhood or CBG (in coordination with the installation of NIDs, terminals, and distribution cables).

Of the quotes that were received for suburban and rural buried drop placement, several of them price buried drop placement at the HM 5.0 default values. Because buried drops are rare in urban areas, the expert opinion of outside plant experts was used in lieu of verifiable forward looking alternatives from public sources or ILECs.

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Price quotes for contractor placement of buried drop wire were as follows:
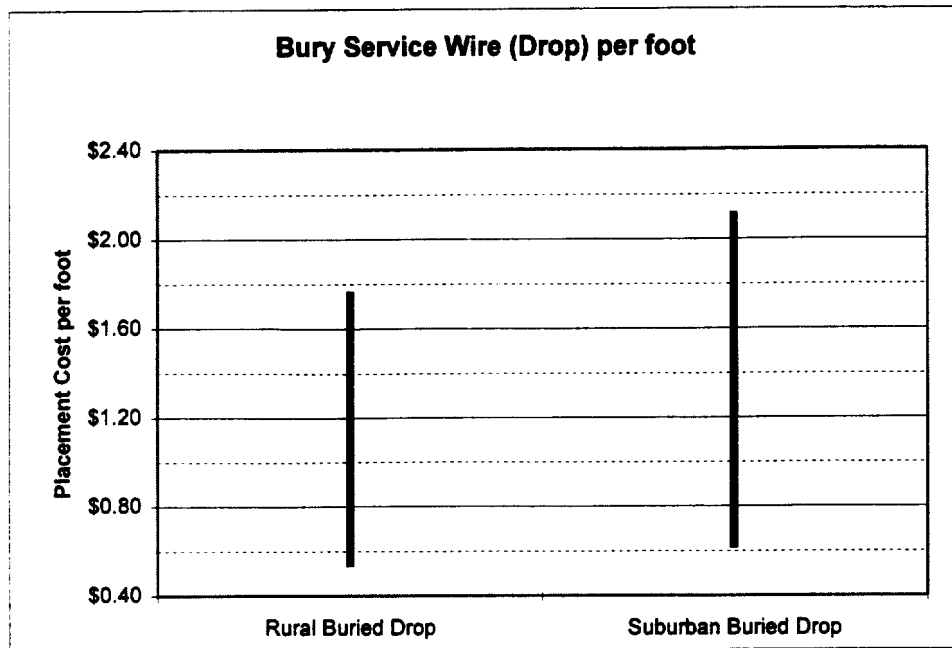
2.2.3. Buried Drop Sharing Fraction

Definition: The fraction of buried drop cost that is assigned to the telephone company. The other portion of the cost is borne by other utilities.

Default Values:

Buried Drop Sharing Fraction	
Density Zone	Fraction
0-5	.50
5-100	.50
100-200	.50
200-650	.50
650-850	.50
850-2,550	.50
2,550-5,000	.50
5,000-10,000	.50
10,000+	.50

Support: Drop wires in new developments are most often placed in conjunction with other utilities to achieve cost sharing advantages, and to ensure that one service provider does not cut another's facilities during the trenching or plowing operation.

Conversations with architects and builders indicate that the builder will most often provide the trench at no cost, and frequently places electric, telephone, and cable television facilities into the trench if material is delivered on site. Research done in Arizona has indicated that developers not only provide trenches, but also provide small diameter PVC conduits across front property lines to facilitate placement of wires.

The Hatfield Model version 5.0 determines the sharing of buried drop structures based on density zones. It is the judgment of outside plant experts that buried drops will normally be used with buried distribution cable. Although many cases would result in three-way sharing of such structure, a conservative approach was to use 50% sharing.

2.2.4. Aerial and Buried Drop Structure Fractions

Definition: The percentage of drops that are aerial and buried, respectively, as a function of CBG density zone.

Default Values:

Drop Structure Fractions		
Density Zone	Aerial	Buried
0-5	.25	.75
5-100	.25	.75
100-200	.25	.75
200-650	.30	.70
650-850	.30	.70
850-2,550	.30	.70
2,550-5,000	.30	.70
5,000-10,000	.60	.40
10,000+	.85	.15

Support: The Hatfield Model version 5.0 determines the use of distribution structures based on density zones. It is the judgment of outside plant experts that aerial drops will normally be used with aerial distribution cable and buried drops with buried and underground distribution cable. Therefore, the percentage of aerial drops equals the percentage of aerial distribution cable (see Section 2.5). The high percentage of aerial drops in the two most dense zones reflects the fact that such drops, if present at all, are extensions of riser cable, which is treated as aerial.

2.2.5. Average Lines per Business Location

Definition: The average number of business lines per business location, used to calculate NID and drop cost. This parameter should be set the same as 5.4.15.

Default Value:

Number of Lines per Business Location
4

Support: The number of lines per business location estimated by HAI is based on data in the *1995 Common Carrier Statistics* and the *1995 Statistical Abstract of the United States.*

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## 2.2.6. Aerial and Buried Terminal and Splice per Line

Definition: The installed cost per line for the terminal and splice that connect the drop to the distribution cable. HM 5.0 assumes use of 25 pair terminals.

Default Values:

Terminal and Splice Investment per Line	
Aerial	Buried
$32.00	$42.50

Support: The figures above represent 25% of the cost of a terminal assuming a terminal is shared between four premises. The full cost is $128 Aerial and $170 Buried for both material and labor for 25 pair terminals. HM 5.0 assigns this investment per line in all but the two lowest density zones, where the cost is doubled to represent two premises served per terminal.

Price quotes for just the material portion were received from several sources. Results were as follows:
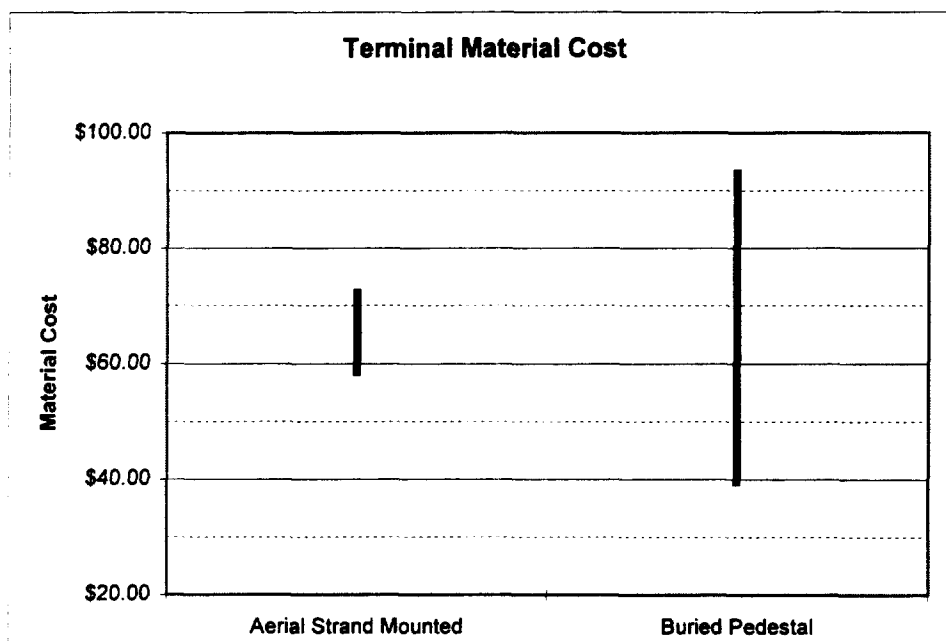

2.2.7. Drop Cable Investment, per Foot and Pairs per Drop

Definition: The investment per foot required for aerial and buried drop wire, and the number of pairs in each type of drop wire.

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Default Values:

Drop Cable Investment, per foot		
	Material Cost Per foot	**Pairs**
Aerial	$0.095	2
Buried	$0.140	3

Support: Price quotes for material were received from several sources. Results were as follows:

Drop Wire Material Cost per foot
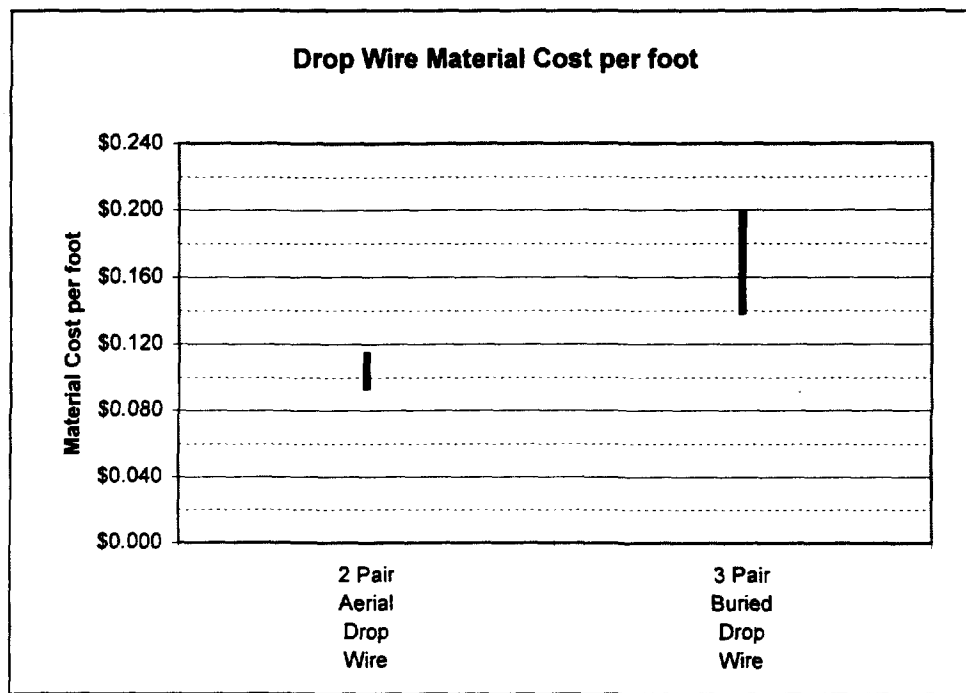
2.3 CABLE AND RISER INVESTMENT

2.3.1. Distribution Cable Sizes

Definition: Distribution plant connects feeder plant, normally terminated at a Serving Area Interface (SAI), to the customer's block terminal. "Distribution network design requires more distribution pairs than feeder pairs, so distribution cables are more numerous, but smaller in cross section, than feeder cables."[3] The Hatfield Model default values represent the array of distribution cable sizes assumed to be available for placement in the network.

Default Values:

Cable Sizes
2400
1800
1200
900
600
400
200
100
50
25
12
6

Support: These are cable sizes typically available to, and used by, telephone companies. Although three additional sizes of distribution cable (2100 pair, 1500 pair, and 300 pair cable) can be used, the industry has largely abandoned use of those sizes in favor of reduced, simplified inventory.

2.3.2. Distribution Cable, Cost per Foot

Definition: The cost per foot of copper distribution cable, as a function of cable size, including the costs of engineering, installation, and delivery, as well as the cable material itself.

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[3] Bellcore, *Telecommunications Transmission Engineering*, 1990, p. 91.

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Default Values:

Copper Distribution Cable, $/foot	
Cable Size	Cost/foot (including engineering, installation, delivery and material)
2400	$20.00
1800	$16.00
1200	$12.00
900	$10.00
600	$7.75
400	$6.00
200	$4.25
100	$2.50
50	$1.63
25	$1.19
12	$0.76
6	$0.63

Support: These costs reflect the use of 24-gauge copper distribution cable for cable sizes below 400 pairs, and 26-gauge copper distribution cable for cable sizes of 400 pairs and larger. Although 24-gauge copper is not required for transmission requirements within 18,000 feet of a digital central office with a 1,500 ohm limit, or a GR-303 integrated digital loop carrier system with a 1,500 ohm limit, a heavier gauge of copper is used in smaller cable sizes to prevent damage from craft handling wires in distribution terminals and pedestals. For cables of 400 pairs and larger, splices are normally enclosed in splice cases, and are not subject to wire handling problems.

Cable below 400 Pairs: Outside plant planning engineers commonly assume that the cost of cable material can be represented as an a + bx straight line graph. In fact, Bellcore Planning tools, EFRAP I, EFRAP II, and LEIS:PLAN have the engineer develop such an a + bx equation to represent the cost of cable. As technology, manufacturing methods, and competition have advanced, the price of cable has been reduced. While in the past, the cost of copper cable was typically ($0.50 + $0.01 per pair) per foot, current costs are typically ($0.30 + $0.007 per pair) per foot.

In the opinion of expert outside plant engineers whose experience includes writing and administering hundreds of outside plant "estimate cases" (large undertakings), material represents approximately 40% of the total installed cost. This is a widely used rule of thumb among outside plant engineers. Such expert opinions were also used to determine that the average engineering content for installed copper cable is 15% of the installed cost. The remaining 45% represents direct labor for placing and splicing cable, exclusive of the cost of splicing block terminals into the cable.[4]

Cable of 400 Pairs and Larger: As copper cable sizes become larger, engineering cost is based more and more on sheath feet, rather than cable size. The same is true for cable placing and splice set-up. Therefore the linear relationship between the number of copper pairs and installed cost is somewhat reduced. A

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[4] The formula would produce a material price of $0.38/ft. for 12 pair 24 gauge cable, and $0.34/ft. for 6 pair 24 gauge cable. An actual quote for materials was obtained at $0.18/ft. for 12 pair 24 gauge cable, and $0.12/ft. for 6 pair 24 gauge cable. The significant difference in material cost is perceived to be the result of the very small quantity of sheath required for 12 and 6 pair cables. Therefore, the formula generated material price was reduced by $0.20 and $0.22 for 12 and 6 pair cables respectively, but the engineering and labor components were retained at original formula levels, since neither would be affected by the reduction in material price.

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review of many installed cable costs around the country were used by the engineering team to estimate the installed cost of copper cable for sizes of 400 pairs and larger.

The following chart represents the values used in the model.

Copper Distribution Cable
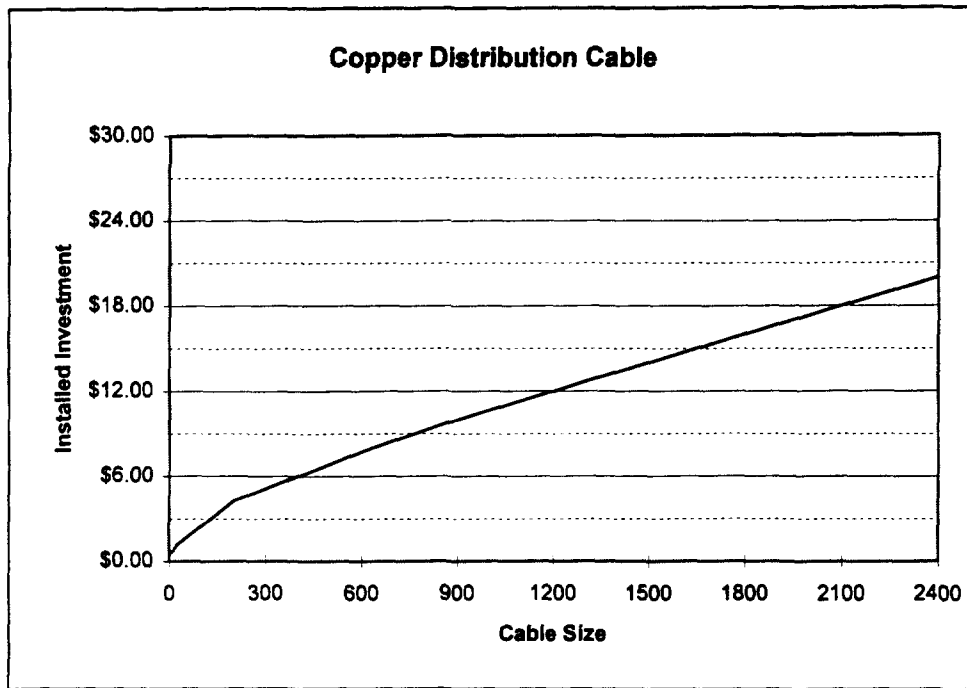
2.3.3. Riser Cable Size and Cost per Foot

Definition: The cost per foot of copper riser cable (cable inside high-rise buildings), as a function of cable size, including the costs of engineering, installation, and delivery, as well as the cable material itself.

Default Values:

Riser Cable, $/foot	
Cable Size	Cost/foot (including engineering, installation, delivery and material)
2400	$25.00
1800	$20.00
1200	$15.00
900	$12.50
600	$10.00
400	$7.50
200	$5.30
100	$3.15
50	$2.05
25	$1.50
12	$0.95
6	$0.80

Support: Riser cable is assumed to cost approximately 25% more than aerial copper distribution cable. Material cost is slightly higher, and the amount of engineering and direct labor per foot is higher than aerial cable.

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2.4. POLES AND CONDUIT

### 2.4.1. Pole Investment

Definition: The installed cost of a 40 foot Class 4 treated southern pine utility pole.

Default Values:

Pole Investment	
Materials	$201
Labor	$216
Total	*$417*

Support: Pole investment is a function of the material and labor costs of placing a pole. Costs include periodic down-guys and anchors. Utility poles can be purchased and installed by employees of ILECs, but are frequently placed by contractors. Several sources revealed the following information on prices.
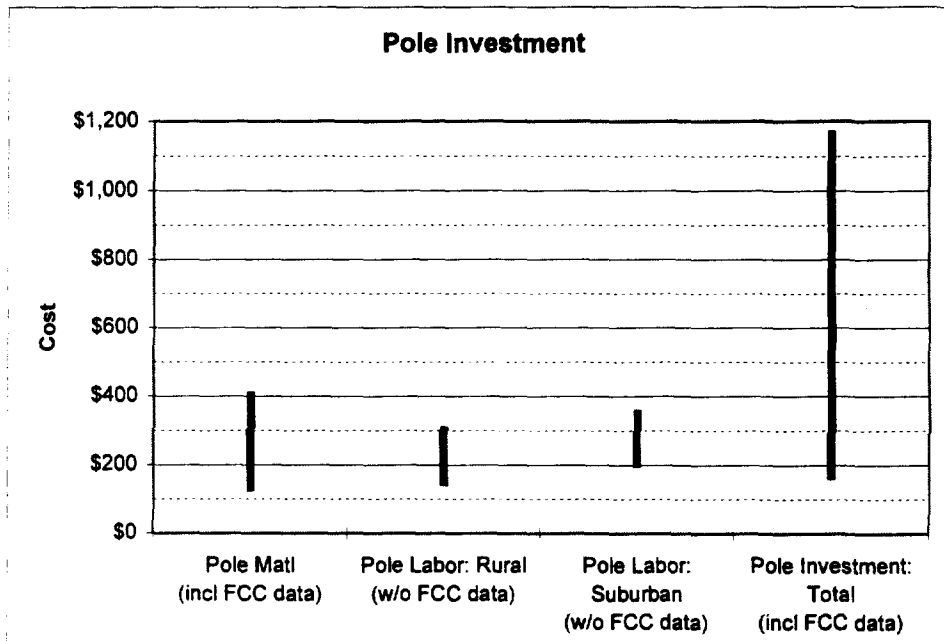
Pole data has also been recently filed by large telephone companies with the FCC. A compilation of that information is shown below:

Pole Costs - Total

Source: FCC Website

Pole Costs - Material

Source: FCC Website

Pole Costs - Labor

Source: FCC
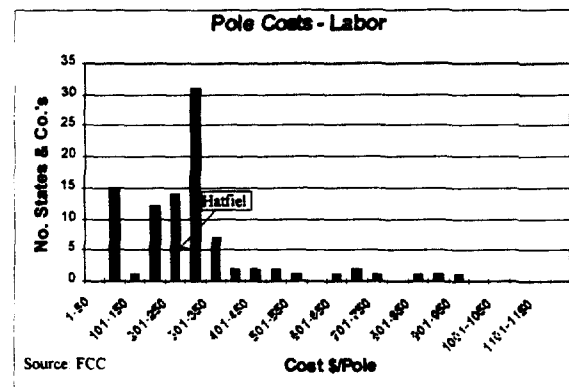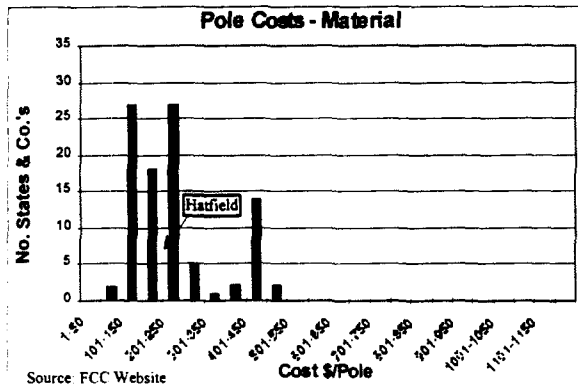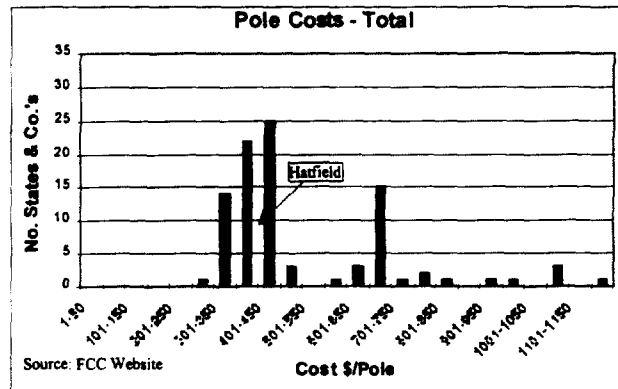
The exempt material load on direct labor includes ancillary material not considered by FCC Part 32 as a unit of plant. That includes items such as downguys and anchors that are already included in the pole placement labor cost. Outside plant engineering experts have concluded that a typical anchor plus anchor rod material investment is $45, and the typical guy material investment is $10. Also, one anchor and downguy per 1,000 feet would be typical. Therefore the embedded anchor and guy exempt material loading included in the default value of $216 is approximately $8.25 - $13.75 per pole.

The steel strand run between poles is likewise an exempt material item, charged to the aerial cable account. The cost of steel strand is not included in the cost of poles; it is included in the installed cost of aerial cable.

2.4.2. Buried Copper Cable Sheath Multiplier (feeder and distribution)

Definition: The additional cost of the filling compound used in buried cable to protect the cable from moisture, expressed as a multiplier of the cost of non-filled cable.

Default Value:

Buried Copper Cable Sheath Multiplier	
Multiplier	1.04

Support: Filled cable is designed to minimize moisture penetration in buried plant. This factor accounts for the extra investment incurred by using more expensive cable and splicing procedures, designed specifically for buried application.

2.4.3. Conduit Material Investment per Foot

Definition: Material cost per foot of 4" PVC pipe.

Default Values:

Material cost per foot of duct for 4" PVC	
4" PVC	$0.60

Support: Several suppliers were contacted for material prices. Results are shown below.
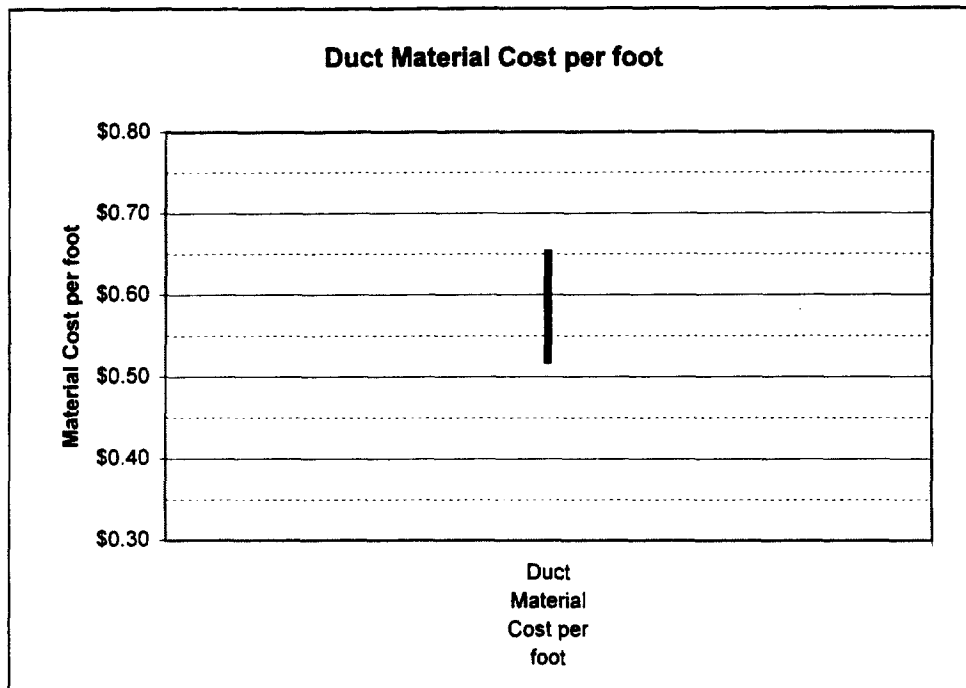
The labor to place conduit in trenches is included in the cost of the trench, not in the conduit cost.

Under the Model's assumptions, a relatively few copper cables serving short distances (e.g., less than 9,000 ft. feeder cable length), and one or more fiber cables to serve longer distances, will be needed. Since the number of cables in each of the four feeder routes is relatively small, the predominant cost is that of the trench, plus the material cost of a few additional 4" PVC conduit pipes.

2.4.4. Spare Tubes per Route

Definition: The number of spare tubes (i.e., conduit) placed per route.

Default Value:

Spare Tubes per Route	
# Spare Tubes	1

Support: "A major advantage of using conduits is the ability to reuse cable spaces without costly excavation by removing smaller, older cables and replacing them with larger cables or fiber facilities. Some companies reserve vacant ducts for maintenance purposes."[5] Version 5.0 of the Hatfield Model provides one spare maintenance duct (as a default) in each conduit run. In addition, if there is also a fiber feeder cable along with a copper feeder cable in the run, an additional maintenance duct (as a default) is provided in each conduit run to facilitate a fiber cable replacement at the same time a copper cable replacement may be required.

2.4.5. Regional Labor Adjustment Factor

Definition: A factor that adjusts the labor cost portion of certain investments to account for regional differences in the availability of trained labor, union contracts, and cost of living factors.

Default Value:

Regional Labor Adjustment Factor	
Factor	1.0

Regional Labor Adjustment Factor Fraction of Installed Investment Affected	
Contractor Trenching	.125
Telco Construction – Copper	.164
Telco Construction – Fiber	.364
Telco I&M – NID & Drop	.571
Pole Placing	.518

Support: Different areas of the country are known to experience variations in wages paid to technicians, depending on availability of trained labor, union contracts, and cost of living factors. The adjustment applies only to that portion of installed costs pertaining to salaries. It does not apply to loading factors such as exempt material, construction machinery, motor vehicles, leases and rentals of special tools and work equipment, welfare, pension, unemployment insurance, workers compensation insurance, liability insurance, general contractor overheads, subcontractor overheads, and taxable and non-taxable fringe benefits.

The regional adjustment factor is applied to the model as follows. For heavy construction of outside plant cable, the model assumes a fully loaded direct labor cost of $55.00 per hour for a placing or splicing technician who receives pay of $20 per hour. For copper feeder and copper distribution cable, the Hatfield Model assumes that this fully loaded direct labor component accounts for 45% of the investment.

Because $20 is 36.4% of the fully loaded $55 per hour figure, the effect of the Regional Labor Adjustment Factor is 0.364 x .45, or 16.4% of the installed cost of copper cable. Therefore, the labor adjustment factor is applied to 16.4% of the installed cost of copper cable.

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[5] Bellcore, *BOC Notes on the LEC Networks - 1994*, p. 12-42.

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The labor adjustment factor also applies to pole labor, NID installation, conduit and buried placement, and drop installation. In the feeder plant, the factor applies to manhole and pullbox installation as well as to cable and other structure components.

Contract labor is used for buried trenching, conduit trenching, and manhole/pullbox excavation. Contract labor (vs. equipment + other charges) is 25% of total contractor cost. Direct salaries are 50% of the "labor & benefits" cost. The fraction of investment that represents labor cost for these items, and is, therefore, subject to the regional labor adjustment factor, is 0.25 times 0.50, or 0.125 of the trenching and excavation costs.

Once the adjustment factors are determined in this fashion, the factor is multiplied by the corresponding unit cost to determine the amount of investment affected by the adjustment. This amount is then multiplied by the specific regional labor adjustment factor to determine the modified investment. For instance, if buried installation trenching per foot is normally $1.77, the adjustment factor of 0.125 applied to this amount is $0.2213. If the regional adjustment was 1.07 (e.g., California), the increased installation cost is 0.07 times $0.2213, or $0.015.

Application of Regional Labor Adjustment Factor on Buried Installation			
Density Zone	Buried Installation per Foot	Labor Content Affected	Investment Affected per Foot
0-5	$1.77	0.125	$0.2213
5-100	$1.77	0.125	$0.2213
100-200	$1.77	0.125	$0.2213
200-650	$1.93	0.125	$0.2413
650-850	$2.17	0.125	$0.2713
850-2,550	$3.54	0.125	$0.4425
2,550-5,000	$4.27	0.125	$0.5338
5,000-10,000	$13.00	0.125	$1.6250
10,000+	$45.00	0.125	$5.6250

Application of Regional Labor Adjustment Factor on Conduit Installation			
Density Zone	Conduit Installation per Foot	Labor Content Affected	Investment Affected per Foot
0-5	$10.29	0.125	$1.2863
5-100	$10.29	0.125	$1.2863
100-200	$10.29	0.125	$1.2863
200-650	$11.35	0.125	$1.4188
650-850	$11.38	0.125	$1.4225
850-2,550	$16.40	0.125	$2.0500
2,550-5,000	$21.60	0.125	$2.7000
5,000-10,000	$50.10	0.125	$6.2625
10,000+	$75.00	0.125	$9.3750

Application of Regional Labor Adjustment Factor on Manhole Installation			
Density Zone	Manhole Excavation & Backfill	Labor Content Affected	Investment Affected per Manhole
0-5	$2,800	0.125	$350
5-100	$2,800	0.125	$350
100-200	$2,800	0.125	$350
200-650	$2,800	0.125	$350
650-850	$3,200	0.125	$400
850-2,550	$3,500	0.125	$438
2,550-5,000	$3,500	0.125	$438
5,000-10,000	$5,000	0.125	$625
10,000+	$5,000	0.125	$625

Application of Regional Labor Adjustment Factor on Fiber Pullbox Installation			
Density Zone	Pullbox Excavation & Backfill	Labor Content Affected	Investment Affected per Pullbox
0-5	$220	0.125	$27.50
5-100	$220	0.125	$27.50
100-200	$220	0.125	$27.50
200-650	$220	0.125	$27.50
650-850	$220	0.125	$27.50
850-2,550	$220	0.125	$27.50
2,550-5,000	$220	0.125	$27.50
5,000-10,000	$220	0.125	$27.50
10,000+	$220	0.125	$27.50

Application of Regional Labor Adjustment Factor on Copper Distribution Cable Installation			
Copper Distribution Cable Size	Installed Copper Distribution Cost	Labor Content Affected	Investment Affected per Foot
2,400	$20.00	0.164	$3.28
1,800	$16.00	0.164	$2.62
1,200	$12.00	0.164	$1.97
900	$10.00	0.164	$1.64
600	$7.75	0.164	$1.27
400	$6.00	0.164	$0.98
200	$4.25	0.164	$0.70
100	$2.50	0.164	$0.41
50	$1.63	0.164	$0.27
25	$1.19	0.164	$0.20
12	$0.76	0.164	$0.12
6	$0.63	0.164	$0.10

Application of Regional Labor Adjustment Factor on Copper Riser Cable Installation			
Copper Distribution Cable Size	Installed Copper Distribution Cost	Labor Content Affected	Investment Affected per Foot
2,400	$25.00	0.164	$4.10
1,800	$20.00	0.164	$3.28
1,200	$15.00	0.164	$2.46
900	$12.50	0.164	$2.05
600	$10.00	0.164	$1.64
400	$7.50	0.164	$1.23
200	$5.30	0.164	$0.87
100	$3.15	0.164	$0.52
50	$2.05	0.164	$0.34
25	$1.50	0.164	$0.25
12	$0.95	0.164	$0.16
6	$0.80	0.164	$0.13

Application of Regional Labor Adjustment Factor on Copper Feeder Cable Installation			
Copper Feeder Cable Size	Installed Copper Feeder Cost	Labor Content Affected	Investment Affected per Foot
4,200	$29.00	0.164	$4.76
3,600	$26.00	0.164	$4.26
3,000	$23.00	0.164	$3.77
2,400	$20.00	0.164	$3.28
1,800	$16.00	0.164	$2.62
1,200	$12.00	0.164	$1.97
900	$10.00	0.164	$1.64
600	$7.75	0.164	$1.27
400	$6.00	0.164	$0.98
200	$4.25	0.164	$0.70
100	$2.50	0.164	$0.41

Application of Regional Labor Adjustment Factor on Fiber Feeder Cable Installation				
Fiber Feeder Cable Size	Installed Fiber Feeder Cost	Labor Content Affected	Factor	Investment Affected per Foot
216	$13.10	$2.00	0.364	$0.73
144	$9.50	$2.00	0.364	$0.73
96	$7.10	$2.00	0.364	$0.73
72	$5.90	$2.00	0.364	$0.73
60	$5.30	$2.00	0.364	$0.73
48	$4.70	$2.00	0.364	$0.73
36	$4.10	$2.00	0.364	$0.73
24	$3.50	$2.00	0.364	$0.73
18	$3.20	$2.00	0.364	$0.73
12	$2.90	$2.00	0.364	$0.73

Application of Regional Labor Adjustment Factor on Outdoor SAI Installation			
Outdoor SAI Total Pairs Terminated	Installed Outdoor SAI	Labor Content Affected	Investment Affected per Outdoor SAI
7,200	$10,000	0.164	$1,640
5,400	$8,200	0.164	$1,345
3,600	$6,000	0.164	$984
2,400	$4,300	0.164	$705
1,800	$3,400	0.164	$558
1,200	$2,400	0.164	$394
900	$1,900	0.164	$312
600	$1,400	0.164	$230
400	$1,000	0.164	$164
200	$600	0.164	$98
100	$350	0.164	$57
50	$250	0.164	$41

Application of Regional Labor Adjustment Factor on Indoor SAI Installation			
Indoor SAI Distribution Cable Size	Installed Indoor SAI	Labor Content Affected	Investment Affected per Indoor SAI
7,200	$3,456	0.164	$567
5,400	$2,592	0.164	$425
3,600	$1,728	0.164	$283
2,400	$1,152	0.164	$189
1,800	$864	0.164	$142
1,200	$576	0.164	$94
900	$432	0.164	$71
600	$288	0.164	$47
400	$192	0.164	$31
200	$96	0.164	$16
100	$48	0.164	$8
50	$48	0.164	$8

Telco Installation & Repair labor (Drop & NID installation): Regional Labor Adjustment Factor applies to $20 of the $35 loaded labor rate (exclusive of exempt material loadings).

Application of Regional Labor Adjustment Factor on NID Installation			
Type of NID	NID Basic Labor	Labor Content Affected	Investment Affected per NID
Residence	$15.00	0.571	$8.57
Business	$15.00	0.571	$8.57

Application of Regional Labor Adjustment Factor on Aerial Drop Installation			
Density Zone	Installed Aerial Drop	Labor Content Affected	Investment Affected per Drop
0-5	$23.33	0.571	$13.33
5-100	$23.33	0.571	$13.33
100-200	$17.50	0.571	$10.00
200-650	$17.50	0.571	$10.00
650-850	$11.67	0.571	$6.67
850-2,550	$11.67	0.571	$6.67
2,550-5,000	$11.67	0.571	$6.67
5,000-10,000	$11.67	0.571	$6.67
10,000+	$11.67	0.571	$6.67

Application of Regional Labor Adjustment Factor on Buried Drop Installation			
Density Zone	Installed Buried Drop per Foot	Labor Content Affected	Investment Affected per Drop
0-5	$0.60	0.125	$0.075
5-100	$0.60	0.125	$0.075
100-200	$0.60	0.125	$0.075
200-650	$0.60	0.125	$0.075
650-850	$0.60	0.125	$0.075
850-2,550	$0.75	0.125	$0.094
2,550-5,000	$1.13	0.125	$0.141
5,000-10,000	$1.50	0.125	$0.188
10,000+	$5.00	0.125	$0.625

Application of Regional Labor Adjustment Factor on Pole Installation			
Total Pole Investment	Pole Labor	Labor Content Affected	Investment Affected per Pole
$417	$216	0.518	$216

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The following chart shows recommended default values for each state.

Regional Labor Adjustment Factor:

Direct Labor costs vary among regions in the United States. A variety of sources can be used for labor adjustment factors.[6] The following statewide labor adjustment factor indexes can be used as default values:

State	Factor[7]
Alaska	1.25
Hawaii	1.22
Massachusetts	1.09
California	1.07
Michigan	1.01
New York	1.00
New Jersey	1.00
Rhode Island	1.00
Illinois	1.00
Minnesota	0.99
Connecticut	0.98
Pennsylvania	0.97
Nevada	0.95
Washington (State)	0.92
Oregon	0.92
Delaware	0.92
Indiana	0.92
Missouri	0.90
Maryland	0.89
New Hampshire	0.86
Montana	0.85
West Virginia	0.84
Ohio	0.83
Wisconsin	0.83
Arizona	0.81
Colorado	0.77

[6] See, for example, R.S. Means Company, Inc., *Square Foot Costs, 18th Annual Edition,* 1996, p.429-433.

[7] Martin D. Kiley and Marques Allyn, eds., *1997 National Construction Estimator 45th Edition,* pp. 12-15. [Normalized for New York State as 1.00]

State	Factor[7]
New Mexico	0.76
Vermont	0.75
Iowa	0.74
North Dakota	0.74
Idaho	0.73
Maine	0.73
Kentucky	0.73
Louisiana	0.72
Kansas	0.71
Utah	0.71
Tennessee	0.70
Oklahoma	0.69
Florida	0.68
Virginia	0.67
Nebraska	0.65
Texas	0.65
South Dakota	0.64
Georgia	0.62
Arkansas	0.61
Wyoming	0.60
Alabama	0.58
Mississippi	0.58
South Carolina	0.55
North Carolina	0.51

2.5. BURIED, AERIAL, AND UNDERGROUND PLACEMENT FRACTION

Definition: Outside plant structure refers to the set of facilities that support, house, guide, or otherwise protect distribution and feeder cable. There are three types of structure: aerial, buried, and underground.

a) Aerial Structure

Aerial structure includes poles and associated hardware.[8] Pole investment is a function of the material and labor costs of placing a pole. A user-adjustable input adjusts the labor component of poles investment to local conditions. The Hatfield Model computes the total investment in aerial distribution and feeder structure within a CBG by evaluating relevant parameters, including the distance between poles, the investment in the pole itself, the total cable sheath mileage, and the fraction of aerial structure along the route.

Poles are assumed to be 40 foot Class 4 poles. The spacing between poles for aerial cable is fixed within a given density range, but may vary between density ranges.

b) Buried Structure

Buried structure consists of trenches. The additional cost for protective sheathing and waterproof filling of buried cable is a fixed amount per foot in the case of fiber cable, and is a multiplier of cable cost in the case of copper cable.[9] The total investment in buried structure is a function of total route mileage, the fraction of buried structure, investment in protective sheathing and filling and the density-range-specific cost of trenching.

c) Underground Structure

Underground structure consists of conduit and, for feeder plant, manholes and pullboxes. Manholes are used in conjunction with copper cable routes; pullboxes are used with fiber cable. The total investment in a manhole varies by density zone, and is a function of the following investments: materials, frame and cover, excavation, backfill, and site delivery. Investment in fiber pullboxes is a function of materials and labor. Underground cables are housed in conduit facilities that extend between manholes or pullboxes. The total investment in underground structure is a function of total route mileage, the fraction of underground structure, investment in conduit, manholes and pullboxes for copper and fiber feeder or plant, and the cost of trenching needed to hold the conduit.

In each line density range, there may be a mixture of aerial, buried, and underground structure. For example, in downtown urban areas it is frequently necessary to install cable in underground conduit systems, while rural areas may consist almost exclusively of aerial or direct-buried plant.

Users can adjust the mix of aerial, underground and buried cable assumed within the Hatfield model. These settings may be made separately by density zone for fiber feeder, copper feeder, and copper distribution cables.

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[8] In the two highest density zones, aerial structure is also assumed to consist of intrabuilding riser cable and "block cable" attached to buildings. In HM 5.0, this "aerial" structure does not include poles.

[9] The default values for sheathing are an additive $0.20 per foot for fiber and a multiplier of 1.04 for copper. The different treatment reflects the fact that the outside dimension of fiber cable is essentially constant for different strand numbers, while the dimension of copper cable increases with the number of pairs it contains.

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d) Buried Fraction Available for Shift

Fraction of buried cable structure input value available to be shifted from buried to aerial or aerial to buried (if the model finds abnormal local terrain conditions making such a shift advantageous, a check in the model preventing percent aerial from going below zero). If the user has entered, for example, an initial value of 0.40 for the buried cable fraction in a given density zone and then enters 0.75 as the buried fraction available for shift, the model can allow the computed buried fraction (according to changes in the relative costs of buried versus aerial structure occasioned by local surface and bedrock conditions) to vary between 0.10 (= 0.40 - 75% of 0.40) and 0.70 (= 0.40 + 75% of 0.40) – subject to the implied aerial fraction remaining non-negative. HM 5.0 uses a "Logistic Choice Curve" to control the sensitivity of the shift in structure to changes in the local relative cost of buried versus aerial plant.
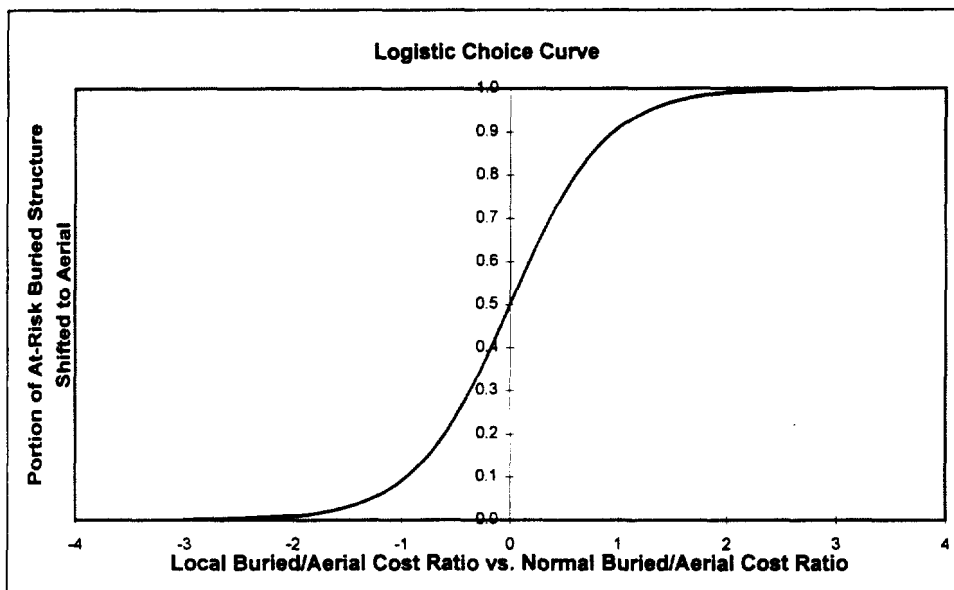
Default Values:

Distribution Cable Structure Fractions				
Density Zone	Aerial/Block Cable	Buried Cable	Underground Cable (calculated)	Buried Fraction Available for Shift
0-5	.25	.75	0	.75
5-100	.25	.75	0	.75
100-200	.25	.75	0	.75
200-650	.30	.70	0	.75
650-850	.30	.70	0	.75
850-2,550	.30	.70	0	.75
2,550-5,000	.30	.65	.05	.75
5,000-10,000	.60	.35	.05	-
10,000+	.85	.05	.10	-

Support: It is the opinion of outside plant engineering experts that density, measured in Access Lines per Square Mile, is a good determinant of structure type. That judgment is based on the fact that increasing density drives more placement in developed areas, and that as developed areas become more dense, placements will more likely occur under pavement conditions.